

## Musings on a warmer, wetter Mars

Mars resembles a cold desert, with temperatures well below freezing and an all but negligible atmosphere. But ancient valleys and long, narrow channels scar its barren terrain, suggesting that water once flowed freely on the Red Planet.

For water to have carved the Martian landscape, conditions during the first half billion years on the planet must have differed dramatically from those that exist today. In the Aug. 5 SCIENCE, Steven W. Squyres of Cornell University and James F. Kasting of Pennsylvania State University in University Park review and evaluate several theories about the evolution of a warmer, wetter Mars.

They note that some scientists have proposed that the ancient Martian valleys were formed by runoff from rainfall. This model assumes that Mars once had an atmosphere dense enough and warm enough for precipitation to occur. But more detailed analyses over the past few years indicate that some of the carbon dioxide thought to be prevalent in the ancient Martian atmosphere would have condensed into clouds. The clouds would have cooled the Martian surface, in part by increasing the reflectivity of the planet to sunlight.

Thus, write Squyres and Kasting, "if conditions early in Martian history really were warmer, climate may be only part of the story."

Heat from within may have played a key role in bringing water to the surface, they and other researchers suggest. Heat left over from the formation of the planet as well as energy generated by debris bombarding the youthful Mars could have caused water to seep from rock and collect above ground.

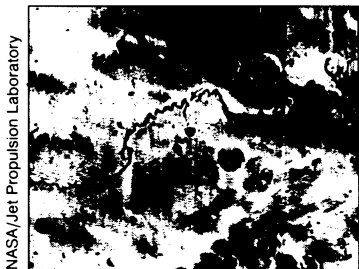
The composition of some meteorites that almost certainly come from the planet also indicates that "Mars was awfully hot on the inside," Squyres says. "Groundwater didn't fall from the sky, it seeped out from the ground," he points out.

However, note Squyres and Kasting, the mere presence of water trickling out onto the surface can't explain the flow of fluid for several hundred kilometers across the planet. Small volumes of water emerging from below ground would readily freeze before moving very far — unless the ancient Martian climate was somewhat warmer than it is today. (In contrast to a trickle, a flood of water would resist freezing and might well carve a channel even on a frigid surface.)

The researchers calculate that if the early Martian atmosphere contained small amounts of methane and ammonia in addition to carbon dioxide, it could have warmed the planet enough to permit the flow of groundwater.

The Mars Global Surveyor, a replacement craft for the lost Mars Observer, may help verify the models, Squyres notes. A thermal infrared spectrometer aboard the Mars-orbiting craft, now scheduled for launch in late 1996, could search for the characteristic signature of hydrothermal minerals — minerals created when rock is heated to high temperatures in the presence of water. On Earth, geologists find hydrothermal minerals at hot springs, such as those in Yellowstone National Park.

In addition, high-resolution images taken by the craft should reveal the depth of the Martian channels. Researchers are uncertain whether the channels have a typical depth of centimeters or meters.



NASA/Jet Propulsion Laboratory

*The Mariner 9 spacecraft captured this view of a sinuous Martian valley more than 2 decades ago.*

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## Quality-of-life scales ignore patients

A woman in her early seventies suffers a mild heart attack. After a brief hospital stay, she goes home. Her new medication makes her feel better physically, but it seems to make her hair thin. Also, she feels mildly depressed.

Despite her important complaints, she might score high on one of the many tools designed to measure quality of life, suggest physicians Thomas M. Gill and Alvan R. Feinstein of Yale University School of Medicine.

To assess how the medical literature measures quality of life, Gill and Feinstein reviewed 75 articles that used one or more quality-of-life questionnaires, they report in the Aug. 24/31 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION.

In only nine studies did the researchers allow patients to comment on how they felt instead of just answering the questions posed. In only six studies were patients asked to rate the importance of the issues raised. For example, researchers tended to ask patients what symptoms they had and not how much those symptoms bothered them.

Investigators defined the term "quality of life" in only 11 articles, although "little agreement has been attained on what it means," Gill and Feinstein note.

In only about one-third of the studies did the authors say why they chose the quality-of-life measurements they used. Such explanations are useful because they help "reassure readers about the instruments' suitability for the intended task," Gill and Feinstein argue.

No article distinguished overall quality of life — which includes, for example, how a patient is getting along with his family as well as how he feels mentally and physically — from health-related quality of life, the Yale team reports.

"The need to incorporate patients' values and preferences is what distinguishes quality of life from all other measures of health," Gill and Feinstein conclude.

## This lucky piglet got whey protein . . .

Studies suggest that some people who have high cholesterol as youngsters continue to have it as adults, even if they eat a healthful diet. As a result, many researchers are studying the potential effect on cholesterol of fat in baby formula.

However, new studies of animals suggest that "feeding different proteins has a big effect on cholesterol," says graduate student Mary R. Larson, of the University of Illinois at Urbana-Champaign. "Our studies show more attention should be paid to protein than is being done."

Larson and her colleagues fed piglets formula with different concentrations of the proteins casein and whey, which most infant formulas use in varying proportions. None of the animals developed dangerously high forms of cholesterol. But those that ate a mixture of 60 percent whey and 40 percent casein had the lowest cholesterol. Those with the highest cholesterol counts ate an all-casein formula.

Piglets with the highest cholesterol also had the lowest concentrations of an enzyme in their liver that helps produce cholesterol. Therefore, the Illinois team suspects that the proteins are influencing a low-density lipoprotein receptor in the liver that also affects cholesterol metabolism, Larson says. She reported these initial findings at the Experimental Biology 94 conference in March.

Because of an allergy to milk, many human newborns eat only formula made from soybeans. So the Illinois team is now testing a soy-derived formula on piglets to see what effect it might have on cholesterol concentrations.

Other researchers have investigated protein's role in the cholesterol figures game, but they have usually used rat pups, says Larson. However, rats, unlike pigs, metabolize cholesterol differently than humans do.

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